CLAIMS

1. A light amplifying fiber comprising:

a first waveguide for transmitting excitation light;

a second waveguide composed of a core containing a laser medium and generating laser light and a clad for transmitting the excitation light; and

a third waveguide including the first waveguide and the second waveguide;

wherein refractive indices of the first waveguide, the clad of the second waveguide, the core of the second waveguide and the third waveguide respectively denoted by n1, n2, n3 and n4 satisfy a relation: $n1 < n4 < n2 < n3$.

2. The light amplifying fiber according to claim 1, wherein the first waveguide has a shape in which a sectional area of a surface perpendicular to a longitudinal direction of the first waveguide is gradually decreased in the longitudinal direction.

3. The light amplifying fiber according to claim 2, wherein an interval between the first waveguide and the second waveguide is constant in the longitudinal direction of the first waveguide.

4. A light amplifying fiber comprising in a longitudinal direction thereof:

at least one idle region for transmitting excitation light and at least one filling region for filling the excitation light in a waveguide containing a laser medium;

wherein the idle region comprises a first waveguide for transmitting the excitation light, a second waveguide composed of a core for generating laser

light and a clad for transmitting the excitation light, and a third waveguide including the first waveguide and the second waveguide;

refractive indices of the first waveguide, the clad of the second waveguide, the core of the second waveguide and the third waveguide respectively denoted by n1, n2, n3 and n4 satisfy a relation: $n1 < n4 < n2 < n3$, and

the filling region includes the second waveguide and the third waveguide.

5. The light amplifying fiber according to claim 4, wherein the third waveguide is provided with an idle region in which excitation light is not present.

6. The light amplifying fiber according to claim 4, wherein the idle region and the filling region are separately provided.

7. The light amplifying fiber according to any one of claims 1 to 6, wherein an outer circumference of the third waveguide is provided with an outer layer for confining excitation light in the third waveguide, and refractive indices of the outer layer and the third waveguide respectively denoted by n5 and n4 satisfy a relation: $n5 < n4$.

8. The light amplifying fiber according to claim 7, wherein the outer layer is formed of glass.

9. The light amplifying fiber according to claim 7, wherein the outer layer is formed of fluororesin.

10. The light amplifying fiber according to claim 1 or 4, comprising a plurality of the first waveguides.

11. The light amplifying fiber according to claim 1 or 4, wherein the third waveguide is formed of ultraviolet curable resin.

12. The light amplifying fiber according to claim 1 or 4, wherein the third waveguide comprises a refractive index matching material or a refractive index matching solution.

13. The light amplifying fiber according to claim 1 or 4, wherein at least a part of a cross-sectional shape of the second waveguide and the third waveguide has a linear shape.

14. The light amplifying fiber according to claim 1 or 4, wherein a core diameter is a size for transmitting a single mode.

15. The light amplifying fiber according to claim 1 or 4, wherein the laser medium is composed of an rare earth element.

16. The light amplifying fiber according to claim 1 or 4, wherein the light amplifying fiber has a feedback means for feeding back light emitted from the light amplifying fiber.

17. The light amplifying fiber according to claim 16, wherein the feedback means is a FBG (Fiber Bragg Grating).

18. A light amplifying method using an excitation source for emitting excitation light and a light amplifying fiber according to any one of claims 1 to 15, wherein the excitation light is allowed to enter a first waveguide of the light amplifying fiber.

19. An laser oscillation method using an excitation source for emitting excitation light, a light amplifying fiber according to any one of claims 1 to 15, and a means for feeding back light generated in the light amplifying fiber, wherein the excitation light is allowed to enter a first waveguide of the light amplifying fiber so as to oscillate laser light.

20. A laser amplifying apparatus comprising an excitation source for emitting excitation light and a light amplifying fiber according to any one of claims 1 to 15, wherein the excitation light is allowed to enter a first waveguide of the light amplifying fiber.

21. A laser oscillation apparatus comprising an excitation source for emitting excitation light, a light amplifying fiber according to any one of claims 1 to 15, and a means for feeding back light generated in the light amplifying fiber, wherein the excitation light is allowed to enter a first waveguide of the light amplifying fiber so as to oscillate the laser light..

22. A laser apparatus comprising a means for guiding light emitted from a laser oscillation apparatus according to claim 21 to a laser amplifying apparatus according to claim 20.

23. A laser apparatus, wherein the guiding means is a fiber, one end of the fiber is fused to a laser oscillation apparatus according to claim 21 and another end of the fiber is fused to a laser amplifying apparatus according to claim 20.

24. The laser apparatus according to claim 22 or 23, wherein the excitation source is a semiconductor laser.

25. The laser apparatus according to any one of claims 22 to 24, wherein the excitation light of the semiconductor laser is transmitted by a fiber and the fiber is connected to a first waveguide.

26. A laser processing machine using a laser apparatus according to any one of claims 22 to 25.